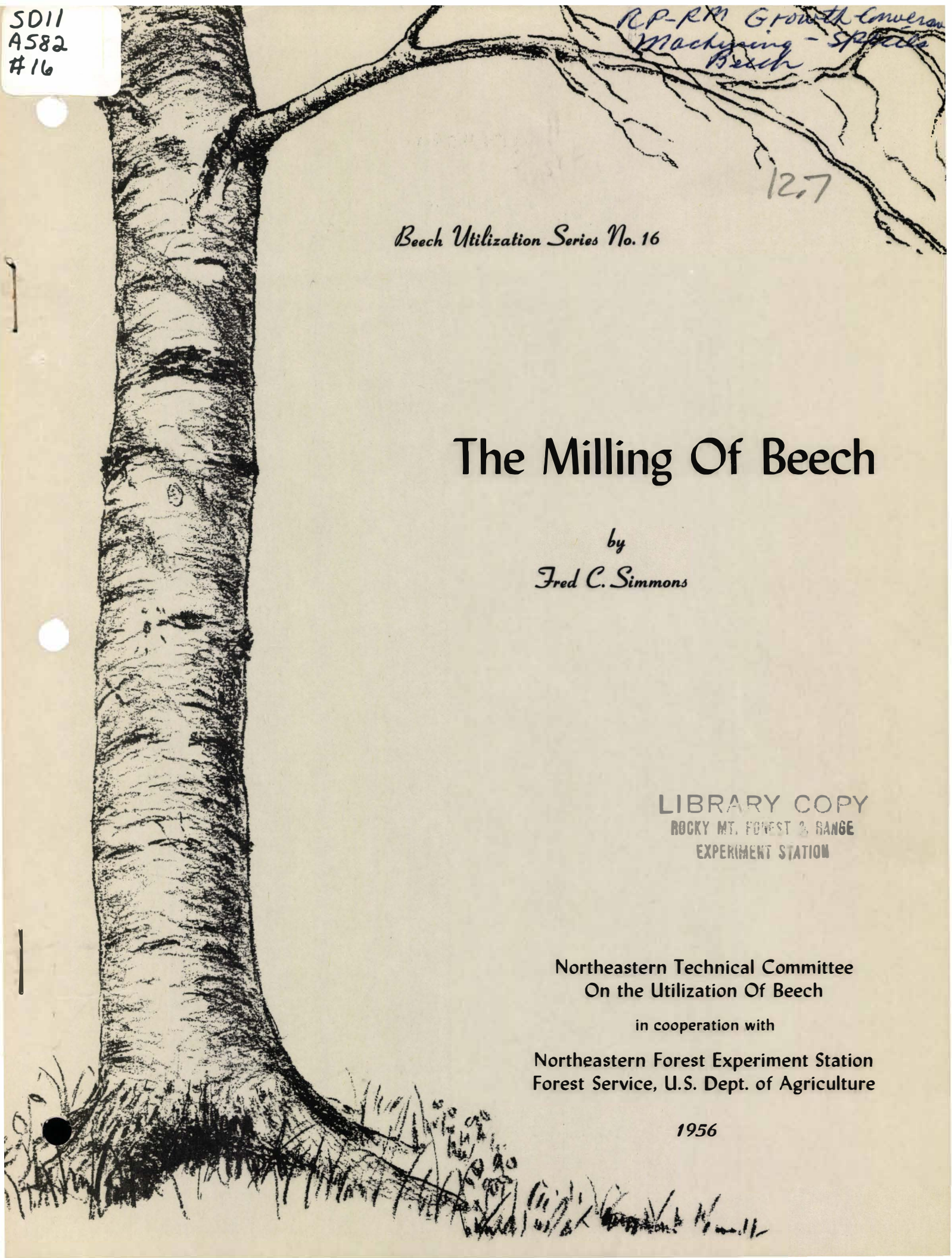

Beech Utilization Series No. 16

The Milling Of Beech

by

Fred C. Simmons

Northeastern Technical Committee
On the Utilization Of Beech

in cooperation with

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. of Agriculture

1956

FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

* Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)

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The Milling Of Beech

by

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INTRODUCTION

THE PLACE OF BEECH in national lumber production has been steadily improving in recent years. In 1947, for example, the U. S. Census of Manufacturers reported that the amount of beech sawed into lumber had increased 246 percent over 1940, while the cut of maple increased only 136 percent and that of birch only 103 percent. The total cut of beech in 1947 was 330 million board feet, while that of maple was 630 million and that of birch was only 175 million.

One reason for this increased cut of beech is certainly that markets for beech lumber are expanding. This is partly because better methods of handling the species have been developed and are becoming more widely used. This is particularly true of seasoning practices.

Another reason for the increased cut of beech lumber is that species that compete with it are becoming scarcer in

our timber stands. The logger is required to remove more beech in his operations; consequently the sawmill operator must process and find markets for greater quantities of it.

A key factor in the production and sale of more beech is the kind of sawmilling techniques used. For the most part, sawmilling practices adapted to beech are not essentially different from those used in sawing other hardwoods. Beech logs are apt to be crooked and defective; but so are those of other hardwoods. Beech sapwood and heartwood differ in their properties, which affects drying and use; the same is true, perhaps to a greater degree, of associated hardwoods like maple and birch. Low-grade beech lumber, including both No. 2 and No. 3 Common, is often difficult to market at a profitable price; this is equally true of other hardwood lumber.

Consequently, most of the recommendations to be made in regard to the milling of beech in this paper apply almost equally well to its associated species. The important difference is that, in some phases of milling, beech requires extra care if it is to be marketed readily and widely. Much of the bad reputation beech has in many markets is due to poor milling. This has been so built up in the minds of many purchasers that the sawmill operator must try, by all means available to him, to turn out beech lumber that is straight-grained, accurately sized, and carefully graded. For many markets, it is desirable to keep the heartwood and sapwood separated in shipments. And the sawmill operator should take extreme care to prevent the development of surface checks in beech lumber before it leaves his hands. This last is perhaps the most important requirement in handling beech. Measures to accomplish these objectives are described in the sections that follow.

GETTING GOOD LOGS

Whether the sawmill operator is running his own logging job or buying his logs from others, he should use every means possible to see that beech timber is bucked into logs properly. Only by good bucking can he insure that the logs he receives will be of the best quality that the trees being cut are capable of producing. Training buckers in log-grading specifications, and then giving them close supervision to make sure that they cut to grade, will pay off if the sawmill operator is running his own logging job. A guide to proper bucking is found in another paper in this

series.[1] Application of these grading principles can raise lumber value yields (in dollars) as much as 15 or 20 percent.

If the sawmill man buys his logs from independent loggers, the problem of getting the best beech logs obtainable from the trees being cut is more difficult. He can encourage better bucking by purchasing his beech logs by grade,[2] or by paying a bonus for the better grades. Another method is to purchase beech in tree lengths and buck them on the mill deck.

The mill operator should also try to obtain his beech logs as freshly cut as possible, to reduce the possibilities of end checks, splits, and entry of stain and decay. "Hot" logging, which means prompt delivery of fresh cut material to the mill, is the practice to be encouraged. Then sawing should be done as promptly as possible after delivery. If the logs have to be stored for any length of time in the woods or in the mill yard, special measures must be taken.

The most effective way of retarding stain and decay is to immerse the logs in water. Less effective, but still worth while, is storing beech in long lengths to reduce the number of exposed ends. Another technique is to treat the logs with end-sealing compounds and toxic sprays. Details of the treatments and a discussion of their relative merits will be found in another paper in this series.[3]

Given logs that are properly bucked and clean, and that are either freshly cut or have been carefully stored, the millman will be well on his way toward producing the best beech lumber possible.

THE MILL

The standard American type of circular sawmill (fig. 1) is a good rig for cutting beech logs for general purposes.

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[1] Simmons, Fred C. Logging beech and specifications for beech products. Northeast. Tech. Com. Util. Beech and Northeast. Forest Expt. Sta., Beech Util. Ser. 10. 30 pp., illus. 1954.

[2] United States Forest Products Laboratory. Hardwood log grades for standard lumber. Proposals and results. U. S. Forest Prod. Lab. Rpt. D1737. 15 pp., illus. Madison, Wis. 1949.

[3] Scheffer, Theodore C., and Zabel, Robert A. Storage of beech logs and bolts in the Northeast. Northeast. Tech. Com. Util. Beech and Northeast. Forest Expt. Sta., Beech Util. Ser. 2. 13 pp., illus. 1951.

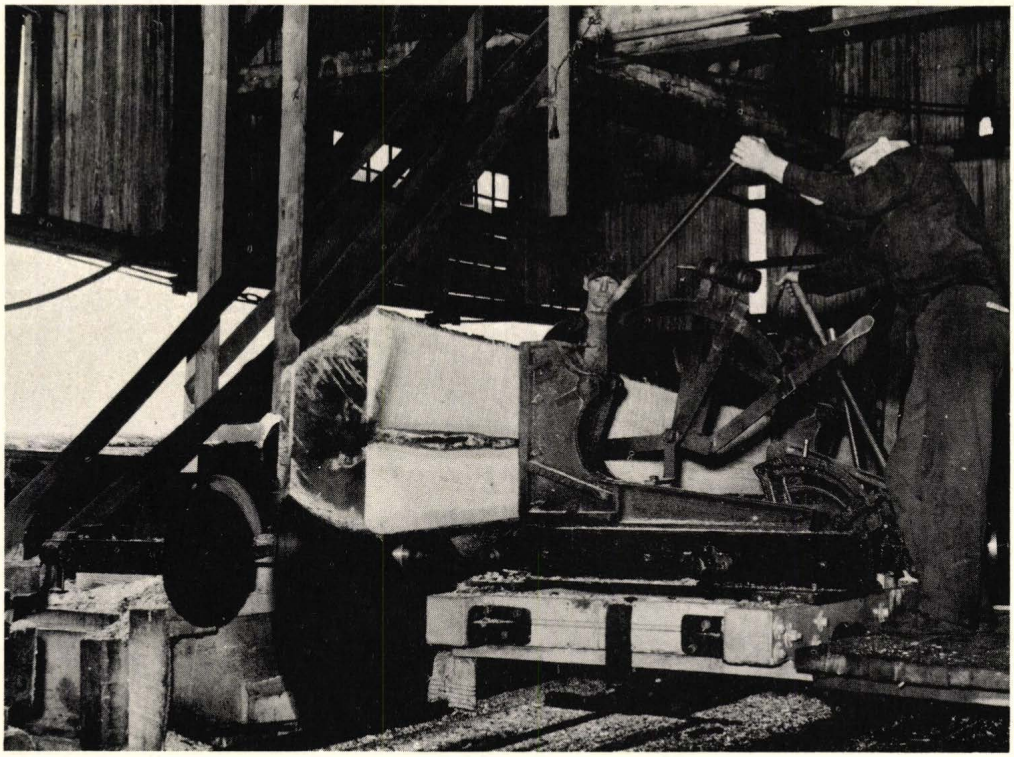

Figure 1.--The standard type of circular sawmill is a general-purpose mill used for cutting beech logs.

The main requirements are that such a mill be sturdy, well maintained, adequately powered, and properly set up.[4] Standard types of band sawmills are suitable too, but they are expensive and they require expert maintenance; so the band mill will not be discussed here. Some of the special requirements of circular mills, when used in cutting beech, will be discussed.

Power-Speed-Feed Relationships

Like its associated species, beech is dense and heavy; so it is important that saw speeds be kept down within the limitations of the available power. A test for this is to see if a cut of the depth ordinarily encountered can be made at a reasonably high rate of feed (3 to 5 inches per revolution of the saw) without appreciably slowing down the saw

[4]Telford, C. J. Small sawmill operator's manual. U. S. Dept. Agr. Handbk. 27. 121 pp., illus. 1952.

speed. If slowing-down occurs, or if a reduction of feed rate is necessary, loss of productivity and inaccurately cut lumber are almost sure to result.

There are many different ways to correct this condition. One, of course, is to install a larger power unit. But this may not be necessary. It has been found that many Northeastern circular sawmills that cut hardwoods are running their saws at too high a speed, and running saws with too many teeth in them. A good goal to aim for, to obtain the most efficient use of power and the most accurate cutting, is to see that each saw tooth takes a bite equal in fractions of an inch to the width of the face being cut in inches (1/8 inch in an 8-inch face, 1/12 inch in a 12-inch face).

One advantage of this rate of feed is that it produces coarse sawdust. This is important; for coarse dust chambers well in the gullets of the saw and is carried out of the cut instead of slipping down between the saw plate and the face being sawed and thus causing difficulties from heating and snaking. Another advantage is that less power is needed per inch of sawline cut than when a smaller bite per tooth is taken. This means that with limited power the saw will be running more continuously at the speed for which it was tensioned; and this also improves accuracy.

Consequently a saw with 48 teeth should be fed at a rate of 6 inches per revolution in an 8-inch face, and 4 inches per revolution in a 12-inch face. A saw with 60 teeth should be fed at a rate of 8-1/3 inches per revolution in an 8-inch face and 5 inches per revolution in a 12-inch face.

As a rough guide,[5] a mill that has only 50 to 75 horsepower (diesel) available at the mandrel should not attempt to run its saw faster than 400 to 500 r.p.m. for cutting hardwoods. With 100 or more horsepower available at the mandrel, saw speeds of 600 to 700 r.p.m. can probably be sustained. Speeds of more than 800 r.p.m. are not recommended for cutting hardwoods on small circular sawmills.

Of course speed of the saw can be slowed down by either installing a smaller pulley on the power unit or a

[5]Diesel power is used as the standard here because it is probably the most commonly used. By rated horsepower, an electric motor will produce about 20 percent more usable power than a diesel engine, steam about 50 percent more, and gasoline about 25 percent less.

larger pulley on the mandrel. If much change in saw speed is made, the saw itself will have to be re-tensioned to run straight at the new speed.

Many millmen will be surprised to find that they can actually increase productivity by slowing down their saw speed, because then they can feed their hardwood logs through the saw at a more sustained rate.

There may be other difficulties that cause the saw to slow down in the cut. The power unit may not be putting out its rated horsepower because it is dirty or worn. There may be slippage in the feedworks or in the connection between the power unit and the mandrel. Other equipment in the sawmill, such as edgers, blowers, and conveying devices, may be draining too much power away from the headsaw.

Saws

Mills that shift from cutting softwoods to cutting hardwoods like beech may find that they have too many teeth in their saws for efficient and accurate work. As a temporary means of increasing bite per tooth, and proving the advantages of taking a greater bite, dub off the point of every other tooth in the saw, or install a worn-out tooth in every other socket. (But do not take out every other tooth in the saw rim. If you do this the saw will no longer have proper tension.)

It is also necessary for the millman who shifts from cutting softwoods to cutting hardwoods to consider the gage size of his saws. Generally it is better to get a gage or two heavier saw plate for beech and other dense hardwoods, than for softwoods. This will take care of the extra strain developed in cutting beech, and will lessen the need for saw tensioning. Also, it will probably result in more accurate cutting.

Generally the saw plate should be about 4 inches less than twice the diameter of the largest size of log to be sawed. If the largest log is 30 inches, for example, a 56-inch saw would be needed. Bigger logs can be cut by installing a topsaw, or by ripping the occasional bigger log into halves or quarters with a chainsaw before putting it on the carriage.

For saws less than 48 inches in diameter a saw plate of 9-gage thickness at the rim and 8 gage at the center,

with insert points cutting a 17/64-inch kerf, will usually prove adequate. For saws larger than 48 inches an 8- by 7-gage saw plate, and bits cutting a 18/64-inch kerf, are recommended.

In the winter, for cutting frozen hardwoods, it is recommended that these kerf widths be narrowed down 1/64 inch for the same saw-plate thickness. This will tend to prevent the fine slushy sawdust produced in this type of cutting from slipping out of the gullets and down between the plate and the face of the log, which causes heating and snaking difficulties. This can be done by saving saw teeth that have been so worn back in summer sawing that they can no longer be swaged to their original width, putting them together in matched sets, and re-installing them in the saw in the winter. Their shorter length will also provide a mechanically stronger tooth, which will be better able to stand the strains of winter sawing.

Recently some saw companies have brought out special types of teeth or holders, with lips extending into the back side of the gullet area, to keep the sawdust from being thrown down so violently to the bottom of the circle. These are said to help to prevent sawdust from slipping out of the gullet. One company has also brought out a "hole saw," which has 7/8-inch holes drilled in a circle near the rim between each two saw-tooth sockets and just inside the point where the saw guide-pins touch. It is said that these holes pick up and chamber any sawdust that does slip out of the gullets, and carry it out of the cut. Their worth has not been tested enough yet to recommend them unconditionally.

A light side-dressing of freshly swaged and sharpened teeth is a good idea, both summer and winter, for cutting hardwoods. This eliminates out-of-line corners on the teeth and produces a more smoothly cut and salable product. It also provides the opportunity for closer dimensional control of the lumber produced because the lumber can be smoothed on a planer with a shallower cut. Side dressing should make lumber sawed on a circular mill more nearly competitive with bandsawed lumber.

Dogging

Beech bark is relatively smooth, and it flakes off easily. Because of this, unusually good dogging equipment is essential on any mill used to saw beech. Dog points should be kept sharp, and they should be firmly embedded in

the wood of the log. Particularly if the log is to be quarter-sawed (quarter-sawing beech heartwood frequently helps in marketing the product), it is desirable to have the knees equipped with under dogs as well as top dogs.

It is extremely important that a mill used to saw beech be equipped with taper set-outs on all knees or, better yet, individually adjustable knees. In the first place, these set-outs are needed for proper support of crooked logs. In the second place, on straight logs--even though beech is not apt to have excessive taper--the outside cuts should be made as nearly parallel to the bark as possible, for this is the way to obtain maximum yields of the higher grades of lumber. Finally, taper set-outs help to segregate the heartwood and sapwood, a practice very important in sawing beech.

If the mill is not equipped with taper-setting devices, wedge-shaped blocks can be used to set the log out. This is a rough expedient, but better than nothing.

Sizing Accuracy

With a sturdy and well-set-up mill that is mechanically in good condition, is well operated, and has saw speeds held down to the limitations of the available power, it should be possible to saw beech and other dense hardwoods to reasonable accuracy standards. It will still be necessary, however, to saw lumber 1/16 inch oversize for each inch of nominal thickness because of the shrinkage that is to be expected in drying.[6]

Because of variations in sawing accuracy, even the best mills allow another 1/16 inch for variations in sawing, and poorer mills add 1/8 inch or more. (Hardwoods are measured and graded air-dry because the better grades are almost invariably used in a kiln-dry condition, and further allowance for shrinkage in kiln-drying is necessary. Softwoods, on the other hand, are commonly used air-dry, so they can be sawed more nearly "on the mark.")

There is another justification for sawing beech a little oversize. Because of its high tangential shrinkage rates and the natural grain characteristics of the species,

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[6] Paul, Benson H., and Drow, John T. Some physical and mechanical properties of American beech. Northeast. Tech. Com. Util. Beech and Northeast. Forest Expt. Sta., Beech Util. Ser. 1. 17 pp., illus. 1951.

surface-checking of flat-sawed stock is not uncommon. Care in handling can reduce this checking to a minimum, but a 1/16 inch or so of extra thickness will enable the planer operator to remove any light surface checks that do develop.

SAWING BEECH

Recommended practice for sawing beech sawlogs on a standard sawmill will vary with the product being made and the quality of the individual logs on hand for sawing.

The way any log is first put on the sawmill carriage will, of course, determine the position at which all four faces will be sawed. The grades obtained, and the volume of

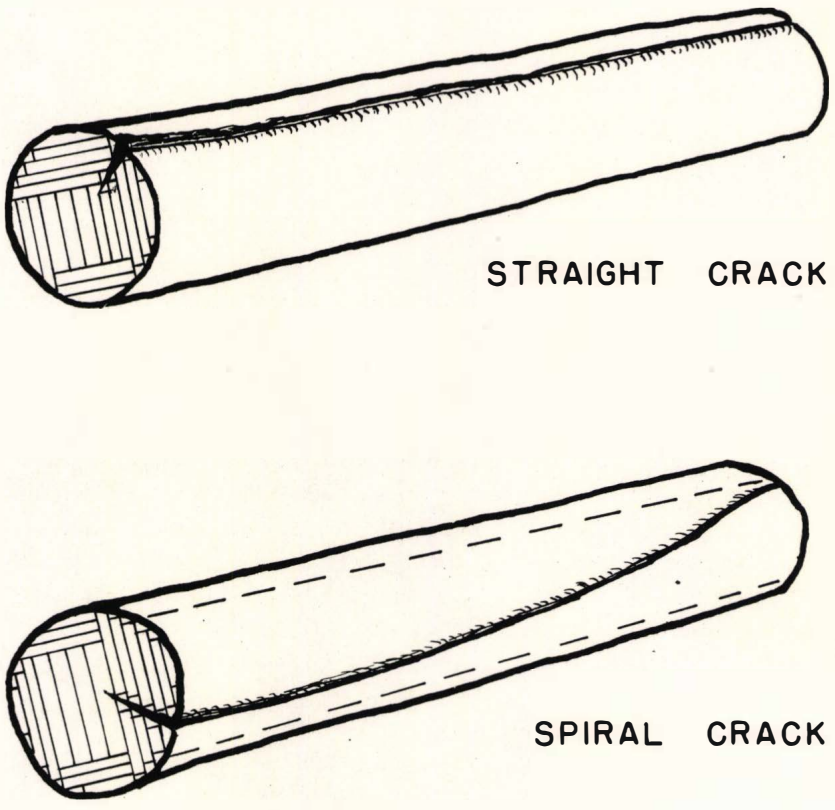


Figure 2.--Methods of sawing a log that has a frost crack. *Top*, a log with a straight crack. *Bottom*, a log with a spiral crack.

usable lumber as well, are strongly influenced by this first positioning of the log.

A prime factor to be considered in sawing beech is the occurrence and type of frost crack. Frost cracks are common in beech logs, particularly those that come from the northern part of its range.

If the frost crack is straight, the log can be positioned so that the crack comes between two of the faces to be sawed (fig. 2). In this way little or no lumber will be lost, because the influence of the crack will be taken out in edgings. Even if the crack has developed some rot, loss will be less than if it were positioned in the center of the face.

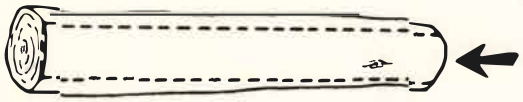
If the crack spirals around the log, an effort should be made to confine its influence to a single face. Short lumber will be produced on this face, but the other faces will be unaffected.

The same principles apply to positioning logs with knots or other defects. Whenever these defects are in line, they can be positioned between two faces and their influence on the resultant cuttings can be minimized. When they are scattered, an effort should be made to confine their influence to one or two faces so that high-grade lumber can be obtained from the other faces on the log.

Face quality is gaged according to log-grading principles as defined by the U. S. Forest Products Laboratory. Several typical faces are illustrated in Figure 3. From No. 1 and No. 2 faces (2/3 or more clear on cuttings not less than 3 feet long) the millman will obtain the higher grades of standard lumber (FAS, Select, and No. 1 Common) before he reaches the heart center. In the following discussion these are called "good faces". From No. 3 faces he will obtain mostly No. 2 Common lumber and from the faces poorer than No. 3 he will obtain only No. 3 Common lumber, or worse. These are called "poor faces" in the discussion that follows.

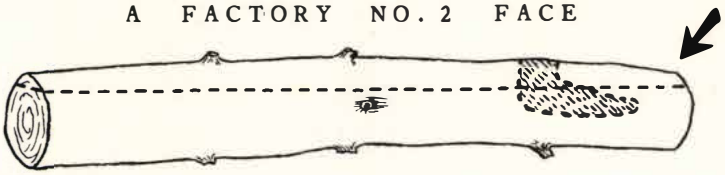
Obviously the millman should strive to obtain the maximum amount of No. 1 Common and better lumber from the log because these are the most profitable grades. Thus he should give his maximum attention to the No. 1 and No. 2 faces, taper-sawing them to obtain the specified minimum widths over the full length of the outer boards, and then

A FACTORY NO. 1 FACE



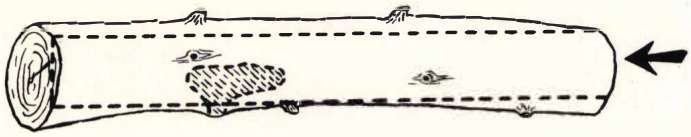
A 10-foot log 16 inches in diameter at the small end. More than 5/6 of its grading-face length is clear in one section 8 feet long.

A FACTORY NO. 2 FACE



A 16-foot log 20 inches in diameter at the small end. More than 2/3 of its grading-face length is clear in three sections 4, 3, and 4 feet long.

A FACTORY NO. 3 FACE



A 14-foot log 22 inches in diameter at the small end. More than 1/2 of its grading-face length is clear in three sections 3, 3, and 4 feet long.

A NON-FACTORY FACE

A 12-foot log 20 inches in diameter at the small end. This is a rough log with many knots. It will not have 50% clear in 2-foot cuttings.

Figure 3.--Some examples of log faces that are typical of different log grades.

taking out the taper in the lower grade heart sections of the log.

The No. 3 and poorer faces will produce only No. 2 Common and poorer lumber, grades that are usually difficult to sell and unprofitable to produce. Consequently, the millman should take steps to move the low-grade material through his mill as rapidly as possible, devoting as little time to it as he can. A beech log that does not have at least three No. 2 faces is generally not worth sawing for factory lumber--unless the millman has special markets. Low-grade logs can be sawed into lumber suitable for flooring, and some poor logs will make good and profitable structural material. This latter applies primarily to those with sound centers.

All this does not mean that every time a good face is sawed the taper set-outs have to be used. If the log has only one good face, it is simpler and better to put this good face against the knee, and make one or two cuts parallel to it on the opposite poor face. Then, whether the mill turns up or down, by the time the log has been rotated 180 degrees the face first sawed will be against the knees, and the good face will be parallel to the saw (fig. 4). In this way there is a flat surface against the knees when the good face is cut, giving a firm bearing and making for accurate cutting. The common practice of sawing the good face first is not conducive to the same degree of accuracy; and it wastes time or high-quality material--or both.

The only time the taper set-outs have to be used on straight logs for this method of sawing is when there are two good faces opposite one another (fig. 5). Then a poor face should be sawed first to get that firm bearing again, but being careful not to saw so deep that high-quality material is taken from either of the adjoining high-quality faces. Then, when a good face is turned to the saw, the small end is set out so that a cut parallel to the bark can be made; and the face is sawed until the grade produced is lower than that obtainable from the adjoining face. The second high-grade face is also sawed parallel to the bark until the grade produced drops below that of the adjoining faces. At this time the set-outs are pulled back and the taper is taken out of the cant either by one wedge-shaped cut, if it is not too big, or by several cuts producing short lumber.

Logs with two adjoining good faces are sawed much the same as logs with one good face (fig. 6 and fig. 7). The good faces are put first against the knee and the bolsters, either in a mill turning up or on one turning down, and the poor faces are sawed just deeply enough to provide a firm bearing when the log is turned and a good face is presented to the saw. Then the good faces are sawed as deep as the good-quality material holds out.

In any of these sawing methods, the center cut of suitable logs can be put into a boxed-heart timber. Making such timbers is often good business, with beech as well as with other hardwoods. Hardwood timbers and heavy blocking are frequently salable in the heavily industrialized Northeast, at prices per thousand board feet that are considerably in excess of the value of the low-grade lumber that could be cut from them, and with a considerable saving of time and cost on the head rig. The low-grade material surrounding rotten hearts, of course, must be made into low-grade boards or dimension lumber, or into chips. (Chipping such material for pulp use is a promising future possibility for disposal of such low-grade hardwood material, and it should be carefully watched by hardwood millmen.)

Quarter-Sawing

True quarter-sawing is generally not worth while with beech because the price differential between quarter-sawed stock and flat-grained stock will not pay for the loss of material and time. There is little excuse for quarter-sawing the sapwood anyway, because beech sapwood is readily salable and is not too difficult to dry without degrade as flat-sawed stock. The highest grade lumber is usually concentrated in the sapwood.

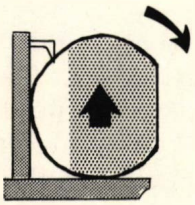
On the other hand, quarter-sawed heartwood of beech should be more readily salable for uses such as flooring, because it is easier to dry without degrade and is dimensionally more stable in use. A high percentage of quarter-sawed stock can be obtained from heartwood cuts if, after the cant is squared up, it is sawed through-and-through from two opposite faces, rather than by doing any additional turning. If in removing the common and better lumber from the exterior, two opposite faces were cut deeper than the other two, one of these faces should be placed against the knees when starting this through-and-through cutting of the heartwood so a minimum of additional flat-sawed stock will be produced (fig. 5, fifth and sixth positions).

METHODS OF SAWING BEECH

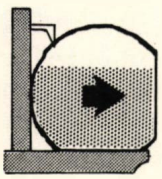
FOR STANDARD GRADED LUMBER

I

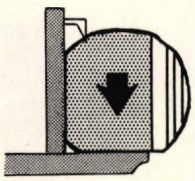
LOGS WITH ONE GOOD FACE. MILL TURNING DOWN.



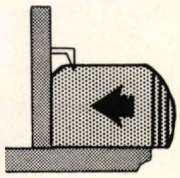
1 GOOD FACE AGAINST KNEE. SAW FIRST POOR FACE PARALLEL TO IT. NO SETOUT USED.



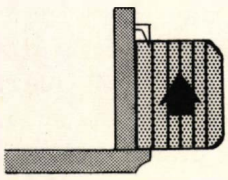
2 TURN LOG DOWN 90°. SLAB SECOND POOR FACE PARALLEL TO HEART.



3 TURN LOG DOWN 90°. SAW GOOD FACE FIRST INTO 4/4 AND THEN INTO 8/4 TO MINIMIZE EDGING LOSS.



4 TURN LOG DOWN 90°. SAW THIRD POOR FACE PARALLEL TO SECOND POOR FACE UNTIL DESIRED WIDTH IS OBTAINED.



5 TURN LOG DOWN 90°. SAW REST OF LOG PARALLEL TO THIRD POSITION TO PRODUCE MAXIMUM OF QUARTER-SAWED MATERIAL.

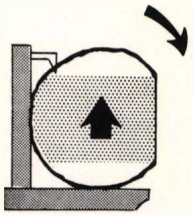
Figure 4.

METHODS OF SAWING BEECH

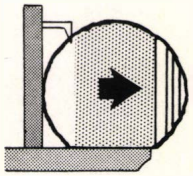
FOR STANDARD GRADED LUMBER

II

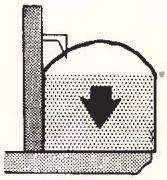
LOGS WITH TWO GOOD FACES OPPOSITE. MILL TURNING DOWN.



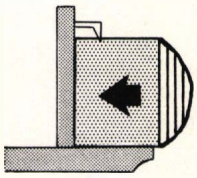
1 GOOD FACES AGAINST BOLSTER AND AT TOP. SLAB FIRST POOR FACE PARALLEL TO HEART.



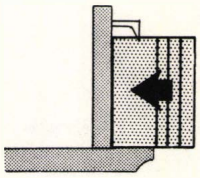
2 TURN LOG DOWN 90°. USE SETOUT AND SAW FIRST GOOD FACE PARALLEL TO BARK.



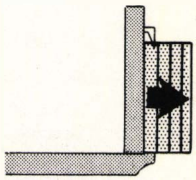
3 TURN LOG DOWN 90°. SLAB SECOND POOR FACE PARALLEL TO FIRST POOR FACE.



4 TURN LOG DOWN 90°. USE SETOUT AND SAW SECOND GOOD FACE PARALLEL TO BARK.



5 REMOVE SETOUT AND SAW WEDGE-SHAPED PIECE TO SQUARE UP CANT. CONTINUE SAWING INTO POOR HEART SECTION TO PRODUCE MAXIMUM OF QUARTER-SAWED MATERIAL.



6 TURN LOG DOWN 180°. SAW THROUGH-AND-THROUGH TO PRODUCE ADDITIONAL QUARTER-SAWED MATERIAL.

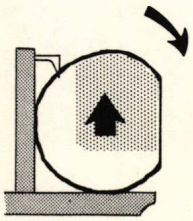
Figure 5.

METHODS OF SAWING BEECH

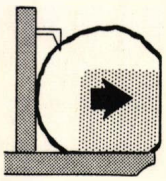
FOR STANDARD GRADED LUMBER

III

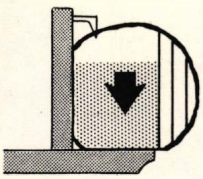
LOGS WITH TWO ADJOINING GOOD FACES. MILL TURNING DOWN.



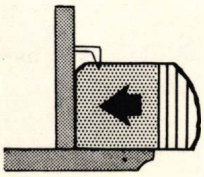
1 GOOD FACES AGAINST KNEE AND BOLSTER. SLAB FIRST POOR FACE NO SETOUT USED.



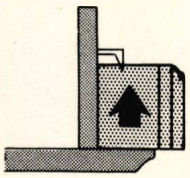
2 TURN LOG DOWN 90°. SLAB SECOND POOR FACE. NO SETOUT USED.



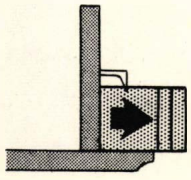
3 TURN LOG DOWN 90°. SAW FIRST GOOD FACE PARALLEL TO BARK. NO SETOUT NEEDED.



4 TURN LOG DOWN 90°. SAW SECOND GOOD FACE PARALLEL TO BARK. NO SETOUT NEEDED.



5 TURN LOG DOWN 90°. CUT PLANK FROM FIRST POOR FACE.



6 TURN LOG DOWN 90°. CUT PLANK FROM SECOND POOR FACE, LEAVING A BOXED-HEART TIMBER.

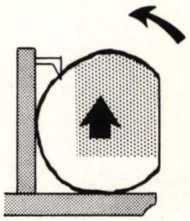
Figure 6.

METHODS OF SAWING BEECH

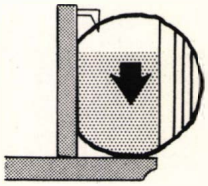
FOR STANDARD GRADED LUMBER

IV

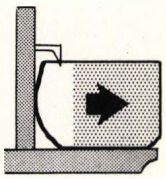
LOGS WITH TWO ADJOINING GOOD FACES. MILL TURNING UP.



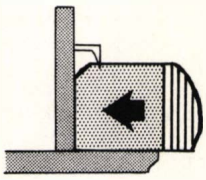
1 GOOD FACES AGAINST BOLSTER AND KNEE. NO SETOUT USED. SLAB FIRST POOR FACE PARALLEL TO OPPOSITE GOOD FACE.



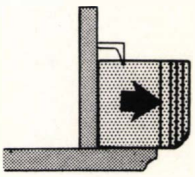
2 TURN LOG UP 180°. SAW FIRST GOOD FACE PARALLEL TO BARK. NO SETOUT NEEDED.



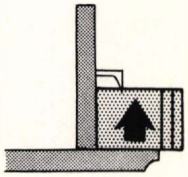
3 TURN LOG UP 90°. SAW SECOND POOR FACE PARALLEL TO SECOND GOOD FACE. NO SETOUT USED.



4 TURN LOG UP 180°. SAW SECOND GOOD FACE PARALLEL TO BARK. NO SETOUT NEEDED.

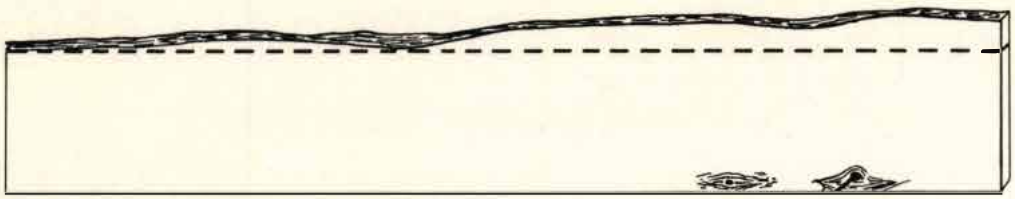


5 TURN LOG UP 180°. SAW SECOND POOR FACE INTO LUMBER AND PLANKS.

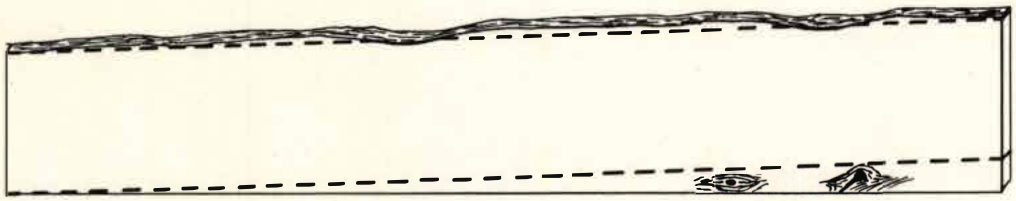


6 TURN LOG UP 90°. SAW PLANKS FROM FIRST POOR FACE, LEAVING A BOXED-HEART TIMBER.

Figure 7.



WRONG



RIGHT

Figure 8.--Sometimes lumber can be upgraded by smart edging. A board like this should be edged parallel to the bark rather than to the sawed edge.

Edging

All the capture of quality is not in the hands of log makers and sawyers. Frequently as much good hardwood lumber, or lumber value, is lost by careless edging as by carelessness elsewhere. This is because many edgermen do not know the applicable lumber-grade specifications,[7] particularly those covering allowable wane; and they edge more closely than necessary. (Even on FAS lumber allowable wane is 1/12 the surface measure of the piece, and it can be half the board length on either or both edges). Much beech lumber is edged closer than necessary.

Some edgermen also fail to take advantage of opportunities to upgrade the pieces they handle. Generally, if

[7]National Hardwood Lumber Association. Rules for measurement and inspection of hardwood lumber. 80 pp., illus. Chicago. 1955.

half or more of the piece being handled can be raised one grade by ripping, such ripping should be done. Also, it is often good business to edge a tapered piece parallel to the bark rather than parallel to the heart or to a sawed edge, to produce higher grade lumber (fig. 8).

A tremendous help to the inexperienced edgerman is an electric shadow-line guide, which shows the line to be cut by the fixed saw (and also by the movable saws) by casting shadow-lines on the board as it is placed on the edger table. Such a guide will usually also add to the efficiency of an experienced edgerman, particularly in a high-speed mill. The edgerman can see instantly from the shadow-line whether he is exceeding the permissible amount of wane for the grade being cut; and he can also see more exactly where to place intermediate and edging cuts to get maximum recovery and yet not exceed the amount of allowable defect for the lumber grade being aimed for.

Trimming

Trimming also provides an opportunity to upgrade lumber production and to reduce the volume of waste. The hardwood lumber-inspection standards require only 50 percent clear face within 1 foot of the ends of the board, even for the FAS grade. Up to 25 percent can be wane or unsound wood. This means that it is not necessary to trim back to eliminate all of the wane or unsound wood to make the grade, or even to eliminate nearly all of it.

Consequently the trimmer operator should be trained to do an efficient job; and he should know the grading and inspection standards that apply to his job.

GANG MILLS

So far this paper has dealt with standard sawmills and ways of using them in milling beech. There are also some special types of sawmills that have advantages for special types of cutting.

A gangsaw mill, which saws automatically parallel to the heart, makes a narrow kerf (about 10/64 inch), and saws very accurately, is useful for cutting construction timbers. During the past few years eleven sash gangsaw mills--all but two of them built in Germany--have been installed at Northeastern sawmills (fig. 9). Most of them are operating on

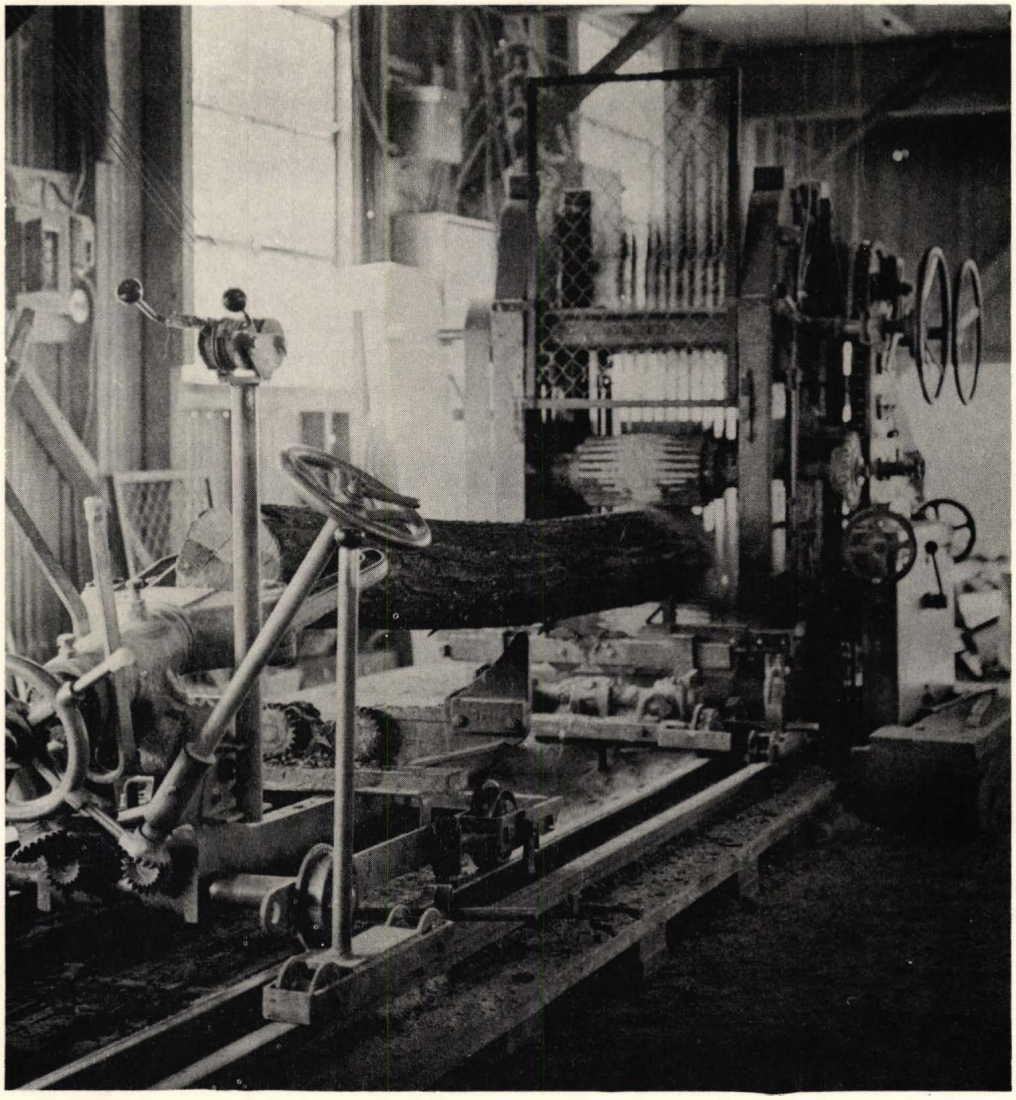


Figure 9.--A sash gangsaw mill, which saws the whole log in one pass. A number of gangsaw mills have been installed in the Northeast in recent years.

softwoods, but a few are cutting hardwoods very successfully, primarily for products like bridge planking and pallet lumber.

Circular gangsaw mills, which use two or more circular saws, are another possibility for cutting this class of material. So far none of these mills have found their way into the Northeast, but a number of them are operating successfully in the South and in eastern Canada. Because of heating difficulties experienced when a number of circular

saws are mounted on the same mandrel, special types of saws that cut a kerf almost 3/8 inch wide have to be used on these mills. In some uses the accuracy and productivity of this type of mill will offset the loss due to the wide kerf.

One of the greatest difficulties when round logs are fed through a sash gang mill is that the feed rolls will not handle irregularities properly, and the logs will heave and turn as they are being fed through the machine, causing jams and breakage and inaccurate cutting. Some Northeastern lumbermen solve this by first using a standard sawmill to take off slabs on two opposite faces of each log; then they run the log through the gangsaw so that these flat faces engage the feed rolls. Another practical possibility is to install a twin circular mill ahead of the gang to slab off two faces simultaneously. Mills that have two saws mounted on independent stub mandrels, with hydraulic or mechanical means to adjust the distance between them quickly, are available from several sources.

Sash gangsaw mills to be used on hardwoods have to be built more sturdily, or operated more carefully, with lower rates of feed, than those used on softwoods.

Both swage-set and spring-set saws are used by Northeastern lumbermen in gangsaw mills; but there seems to be a general belief that swage setting is better for hardwoods, and particularly for winter sawing.

SHORT-LOG MILLS

For cutting some kinds of products from beech, the standard short-log sawmill, and the distinctly different New England bolter saw known as the "snapdragon" (fig. 10), offer some very real advantages. Much beech lumber is used in the form of small clear cuttings for products like brush backs, tool handles, and furniture parts. Many of these uses require straight-grained lumber. One of the best ways to obtain this from a species like beech is to cut the tree lengths into short bolts. This is because many of the beech trees found today are sweepy or crooked, which makes it difficult to get straight long logs. Cutting the logs into these short sections should be postponed as long as possible before sawing, to reduce the possibilities of end checks developing.

Beech bolts are generally cut into 4-foot lengths for sawing, but better recovery and higher grades can usually be obtained by varying bolt lengths from 2 to 8 feet, depending on the conformation and other characteristics of the bolt being cut.

The bolter mill is not recommended for general use on diameters greater than 17 inches. This is just about the capacity of a mill with the 32-inch saw that is commonly used. One maker, however, puts out a machine with a topsaw; this can take material up to 23 inches in diameter. But because so much man-handling of the raw material is involved

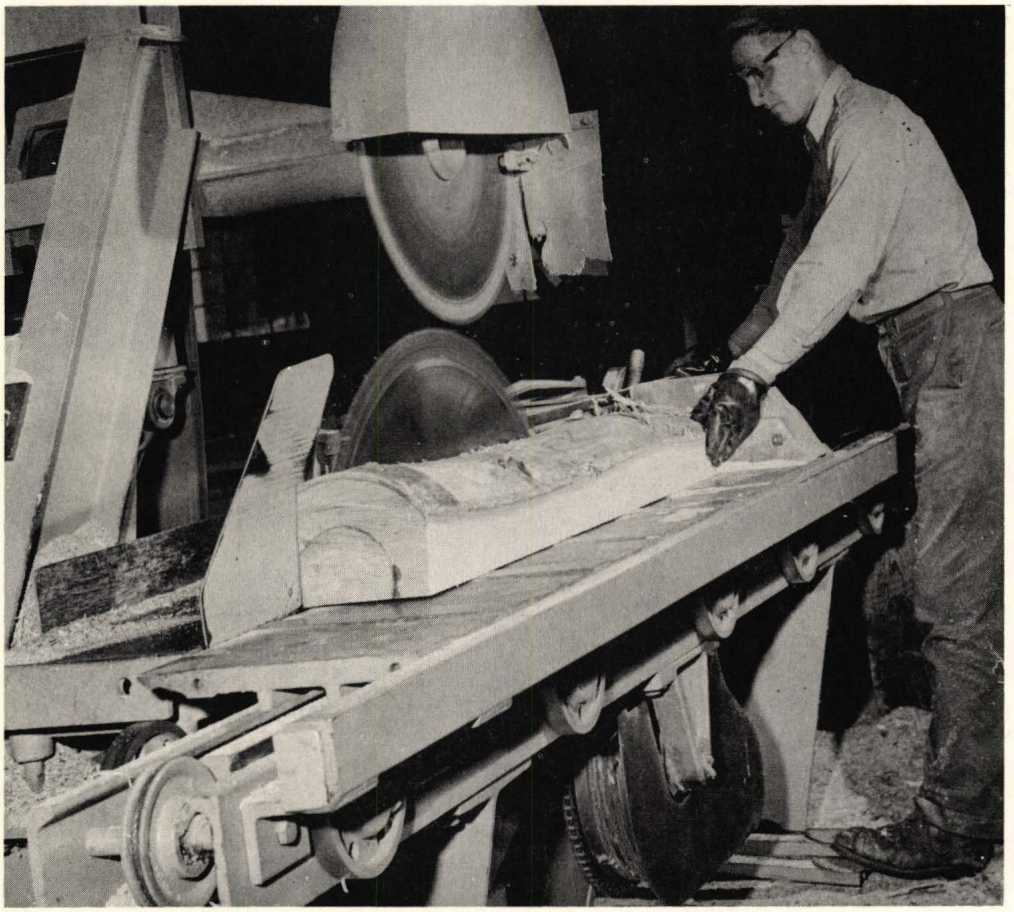


Figure 10.--A bolter saw. These saws, which are made for cutting short bolts, recover more volume and better quality from material like small beech logs than a standard mill does.

in operating a bolter saw, it is generally not good business to cut much hardwood material that large. A standard sawmill with a short-log carriage, equipped with either top or end dogs, is a better machine to handle bolts larger than 17 inches. The bolter is best for handling the smaller bolts, even those as small as 6 inches in diameter.

Experience has proved that well-designed and expertly operated bolter mills can saw accurately and produce well. A number of mills in New England produce 6 to 7 thousand board feet a day with a single bolter machine. More important, these machines recover greater values from material like small beech than a standard mill. One Vermont mill reported that by using a bolter they obtained 704 board feet of short-length lumber from 100 cubic feet of No. 2 beech logs, bucked into short lengths. A similar quantity of the same grade of log put through a conventional long-log mill produced only 543 board feet of lumber. In the opinion of the operator, the material cut on the bolter saw had greater utility for his use (handle and rule stock) than the long lumber because it was straighter grained, had heartwood and sapwood in separate cuttings, and was more accurately sized.

HANDLING & STORING BEECH LUMBER

As emphasized in the paper in this series on seasoning,[8] beech lumber is particularly susceptible to surface-checking. This checking can take place in a matter of minutes on green beech lumber if it is exposed to a hot summer sun. (Checking occurs in winter too, but not so quickly.) Though it is true that many of these surface checks will close as the centers of the boards dry in subsequent seasoning, they will always remain as weak or defacing places in the lumber. Such closed surface checks are responsible for much of the poor reputation that beech has among wood finishers and purchasers of finished products made from beech. Minute dimensional changes in the beech, even after it is dry, result in cracking of the finish along the lines of these closed checks.

Consequently, green beech lumber should not be allowed to lie around exposed for even as much as an hour after

[8] Baker, Gregory, and McMillen, John M. Seasoning beech lumber. Northeast. Tech. Com. Util. Beech and Northeast. Forest Expt. Sta., Beech Util. Ser. 11. 22 pp., illus. 1955.

it is cut. If high-grade beech lumber is being cut only intermittently at the sawmill, and is being piled separate from other species, the pile should be built up under shelter or should be covered with a tarpaulin or temporary roof between periods when fresh material is being put on it. As pointed out in the paper on seasoning, air-seasoning of beech in sheds or other shelter is a good idea in any case.

When thick cuttings of beech are being made for high-quality uses such as furniture legs, gun stocks, heavy turnings, or handles, chemical treatment is about the only way to insure check-free beech, even if the lumber is to be kiln-dried. The chemical treatments should be applied immediately after sawing to forestall early checking. One saw-handle manufacturer is paying $12 a thousand more for chemically treated beech than for beech that is untreated.

MARKETING BEECH LUMBER

The markets for beech are many and varied. The sawmill operator should investigate the available markets before he saws any beech. It may be profitable for him to saw the majority of his high-quality (Select and better) beech side cuts into 5/4 inch thickness rather than 4/4 inch, to take advantage of a special market for a product like tool handles. There may be a special high-priced market for even thicker cuttings of high-quality beech for heavy turnings such as billiard-table legs or shaving-bowl stock. Or specially high-quality beech may be in demand in special thicknesses for resawing into outside laminations for tennis rackets or baseball bats. An operator with good beech logs who saws carefully and protects his green lumber should be able to capitalize on these markets.

Medium quality (No. 1 Common and No. 2 Common) beech might perhaps be best sawed into special thicknesses for processing into flooring, or to be cut up into material for brush backs or furniture parts.

By all means, the market for structural material, including railroad and switch ties, should be looked into.[9] A market for heavy timber stock can reduce enormously the

[9]See: Lane, Paul H., and Fechner, Gilbert H. Sawed tie production in the Tennessee Valley region. Cross Tie Bul. 32 (12): 9-22. 1952.

problem of finding a market for No. 3 Common beech lumber. Some of this structural material might easily be marketable locally for construction of barns, bridges, and similar structures. Simple methods of treating beech timbers with preservatives to make them suitable for such uses will be described in another publication in this series.

Finally, as with other hardwood species, there will be the problem of disposing of the low grades, particularly No. 3-B and "scoots"--the stuff so poor that it does not rate even the lowest grade. Small mills in rural or mining areas can sometimes dispose of this class of material for local rough construction. Near coastal seaports there is usually a market for dunnage and in other industrial areas for car blocking. Pallet producers in some communities buy considerable quantities of low-grade wood. All of these markets, of course, pay very low prices for the material. Consequently, where a market is available, it may be more profitable to cut up this low-grade material, along with the slabs, and sell them for fuel.

Another market possibility that may develop fast is the conversion of low-grade parts of the log into chips for pulp and paper manufacture. This is already being done very extensively at softwood mills on the West Coast, where local markets for low-grade lumber are rather restricted and the sawmills are larger than those in the Northeast. Many of these Western mills station men along the refuse conveyor to pick out bark-free low-grade material, including trimmings and cull lumber, which is then conveyed to a chipper; the product is sold to the pulp mills. Several new horizontal feed chippers are now available that are capable of making uniform clean-cut chips from pieces as short as 4 inches and as thin as lath.

Along with this is the possibility that much of the slab and edging waste developed at Northeastern hardwood sawmills may soon be marketable as pulp chips. Chipping can be done in the same machines recommended above for low-grade lumber cuttings. The present difficulty is that for most pulpmills using hardwoods, chips from slabs and edgings contain too much bark. There are two possibilities of getting around this obstacle. One would be to debark the logs before sawing them. Several log barkers now available have proved successful with hardwoods. They are too expensive, however, for installation at sawmills that cut less than 10,000 board feet a day. The other possibility is to separate the bark from the wood after it has been chipped. This seems to have

considerably more promise. At least three different systems of accomplishing it are now being developed, and one has been put into use at a Northeastern sawmill.

It is within the realm of possibility that in the not too distant future the current problem of disposing of low-grade lumber, and also of slabs and edgings at Northeastern hardwood sawmills, will be solved by making pulp chips from them. This would eliminate one of the major headaches of the hardwood sawmill man, and would make the sawing of beech and its associated hardwoods a much simpler and more profitable operation.

SUMMARY

Northeastern sawmills are cutting more beech every year. This is partly a matter of necessity, and partly because markets for this species, particularly in the better grades, are improving.

To enable the mill operator to make the maximum profit from his beech, it is recommended that he handle it carefully so as to get the maximum proportions of the higher grades of lumber that the trees being cut are capable of producing. This goes back to improvement of bucking practice in the woods, and carries through to the way the logs are placed and turned on the carriage, and the way the cut lumber is handled before shipment. Special care needs to be taken with beech to see that checks and stains do not develop in the logs before they are sawed, and that surface-checking does not occur in the lumber after it is sawed. "Hot" logging is recommended as the best way to minimize the former loss, and piling under shelter to reduce the loss from the latter.

Accuracy of sawing and smooth surface cutting are also recommended as ways to make beech lumber produced on the small mill more readily salable. It is desirable to separate the heartwood and sapwood, so far as is possible, into different cuttings, particularly in the higher grades.

Markets for beech lumber are many and varied. The higher grades can generally be sold at profitable prices for furniture parts, turning squares and bars, handle stock, and other specialty items. The middle grades are salable for brush backs, flooring, and a variety of other uses. In common with other associated hardwoods, the lower grades are

often difficult to sell even at cost-of-production prices. It is recommended that, so far as possible, Northeastern mills put such material into structural items. Production of pulp chips is another possibility.

AGRICULTURE-FOREST SERVICE-UPPER DARBY

(CONTINUED FROM INSIDE OF FRONT COVER)

* Chemistry and chemical utilization of beech.
* Silvicultural characteristics of beech.
  Availability and supply of beech.
  Present markets and uses for beech.
* Logging beech and specifications for products.
* Seasoning beech lumber.
* Storage of beech logs and bolts.
* Machining of beech.
* Milling of beech.
* Gluing techniques for beech.
* Steam-bending of beech.
  Preservative treatment of beech.
* Beech for flooring.
  Beech for furniture.
  Beech for turned products and novelties.
* Beech for veneer and plywood.
* Beech for fuel and charcoal.
* Beech for crossties.
* Beech for containers.
  Pulping and defiberization of beech.
* Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; A. H. Bishop, State University of New York, College of Forestry; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the working committee that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

Ralph W. Marquis

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*Reports published.